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AUTHOR McCowin, Janet D.
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ABSTRACT

This research studied the effects of instructions on children's recall in a free recall learning task. Also investigated were developmental trends, including expected superiority of older children in recall and spontaneous formation of stable organizational groupings. A third area of study concerned the possibility that younger children benefit more than older children from induced organizational strategies. Subjects were 48 male and female public school students from the second and fifth grades. The children were randomly assigned to the experimental conditions which varied with the two different sets of instructions regarding categorization and recall. Results are presented for recall scores on the first recall test, recall over trials, subjective organization, and sorting consistency. The results indicate that instructions to maintain spatially consistent categories and higher recall over trials were effective in producing more consistent categories and higher recall over trials for children of seven and ten years. A positive relationship between consistency in sorting, recall, and number of intertrial repetitions is suggested by the results and while instructions to maintain consistent categories seem to be an important factor, the possibility that the presence of a spatial cue also influenced obtained results cannot be overlooked.
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The Effects of Instruction and Spatial Consistency on Children's Free Recall

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Janet D. McCowin
California State University at Hayward

Data on the extent to which achieving and maintaining stable organizational groups facilitates free recall are of theoretical value to psychologists and of possible practical value to educators. While stable organizational groupings may occur spontaneously in multitrial free recall experiments and may facilitate recall, it is not entirely clear whether maintenance of stability of organizational groupings can be induced, and if induced facilitate recall. The results of a study conducted by Amster and Wiegand (1969) demonstrate that instructions to categorize words may result in increases in recall in an incidental free recall experiment.

It is often suggested that secondary organizational processes emerge as a consequence of considerable prior acquaintance and learning experience with the materials. The importance of such processes should then be markedly reduced or eliminated in very young children and show a progressive increase from early childhood through adolescense and young adulthood (Steinmetz and Battig 1969). It would also be expected that adults and older children will more frequently engage in organizational strategies spontaneously than will younger children. In fact, researchers usually do report a general developmental increase in scores on recall tests and in conceptual organizational strategies employed. These two rather consistent findings come from a number of investigators using a wide variety of kinds of stimulus materials, age groups, number of input and output trials, and temporal intervals (Bousfield Esterson and Whitmarsh, 1958; Amster and Wiegand, 1969; Heckleman and Spear, 1967; Steinmetz and Battig, 1969; Mandler and Stevens, 1967).

The purpose of the present study was to determine if organizational strategies could be induced through instructions and use of a spatial cue and whether such strategies would, if successfully induced, facilitate recall. Additionally, developmental trends, including expected superiority of older children in recall and spontaneous formation of stable organizational groupings were studied. Finally, the possibility that younger children benefit more than do older children from induced organizational strategies was examined.

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Method

Design. The design was basically a 2 x 2 factorial. There were two major variables, Instruction (Categorizing and Same-Categorizing) and Age (7 and 10). List and Sex were added as control variables. Twelve children were assigned at random to each of the major experimental conditions, with equal numbers of boys and girls included in each condition.

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Materials. Two lists of 36 words each were used (see Appendix A). These lists were selected from Mandler (1967) and were used in the Arster and Wiegand study (1969). The basis for selection included the restriction that all words were above 500 on the Thorndike-Lorge (1944) J-count.

Each word was typed, in lower case, on a 3 x 5 inch card. Twelve packs of cards, each pack containing the same (but differently ordered) list of 36 words, were presented to every subject.

An "anchoring" device, consisting of a $8\frac{1}{2}$ x $11\frac{1}{2}$ inch sheet of gray cardboard with four blank 3 x 5 inch cards attached, was placed on the table in front of each subject.

Subjects. A total of 48 students, 24 boys and 24 girls, enrolled in a public school in the San Lorenzo School District, took part in this experiment. Half of these were selected from second grade classrooms with the restriction that they were 7 years old at time of testing. The other half were selected from fifth grade classrooms, with the restriction that they were 10 years old at time of testing. Children were randomly assigned to each of the major experimental conditions, with equal numbers of boys and girls included in each condition. All subjects were tested individually and all were able to complete the testing as scheduled.

Procedure. Each pack of 36 cards was prearranged in order of a balanced, incomplete latin square design over the twelve trials. One trial consisted of presenting all 36 words contained in one pack. On the first two trials, all subjects sorted words sequentially, in a counter-clockwise pattern, on to the spaces provided on the gray card.

Preceding trial three, all subjects were instructed to sort cards into categories (see instructions in Appendix B) and none were alerted to the later test of recall. At this time, the Same-Categorizing subjects received additional instructions to maintain the same categories from sort-to-sort and to keep the groups in the same spatial position on the gray card. The Categorizing subjects received instructions of approximately the same length, consisting of rephrasing of previous instructions.

In presenting cards for sorting, the examiner read the word on the card aloud, handed the card to the subject who repeated the word and then placed it face up in one of four piles. Presentation rate was approximately 4 seconds.

The major experimental conditions varied with the two different sets of instructions given to subjects preceding trial three. Categorizing subjects were instructed to place each card in one of four piles, putting words "that you think go together in the same pile." Instructions for the Same-Categorizing subjects included the above instructions with the addition, "once you are satisfied with your piles, I want you to try to remember which words go in each pile and put them in the same pile each time." The examiner emphasized the Same-Categorizing instructions by pointing to spaces provided on the gray card.

Beginning with trial 3 and continuing through trial 12, recall tests were administered to all groups with all subjects receiving the instructions "tell me all the words you can remember" before the first recall test. The child responded orally and responses were entered on his protocol by the examiner. No additional instructions regarding either sorting procedure or recall were given following trial 3.

After testing was concluded, the child's categories for every trial were recorded. Thus each child's protocol contained a record of his sorts on the twelve trials as well as ordered lists of words recalled for the ten tests administered.

Results

A nested analysis of variance design (described by Marascuilo and Levin, 1970) was employed. A first analysis of variance was performed on the scores for the initial test of recall, a second on scores for tests of recall over trials, and a third on intertrial repetitions (ITR) over trials. Bousfield's (1967) ITR measure was used to estimate subjective organization or the amount of sequential consistency in recall. Sorting consistency is displayed graphically.

Recall scores on the first recall test.

Two analyses of variance were conducted on number of different words recalled correctly on the first recall test (Trial 3), one a nested analysis and the other an overall analysis. Nested results indicate that ten-year-olds received significantly higher first recall scores than did seven-year-olds shown by the main effect for Age ($p < .01$). Same-Categorizing ten-year-olds obtained significantly higher recall scores than did Categorizing ten-year-olds ($p < .05$). This effect was not significant for seven-year-olds alone, however the results obtained from an overall analysis for both ages combined showed a significant effect for Instructions ($p < .05$) and the trend for the seven-year-olds ($F = 2.64$) was consistent with the results for the ten-year-olds. The interaction of Instructions and Age was not significant, thus the Same-Categorizing groups in general scored significantly higher than did Categorizing groups at first recall. No interactions were significant on the analysis of variance for the first recall test.

Recall over trials.

A mixed design analysis of variance (5 x 2 x 2 x 2 x 2) was conducted on the number of words recalled on the 10 recall tests. These were analyzed in five blocks of two trials each. Significant main effects were obtained for Age (p .01), Instruction ($p < .01$), and Trials ($p < .01$). A significant interaction between Instruction and Trials was found at each age level and with ages combined ($p < .01$).

The results indicate that within each instructional group, ten-year-olds recalled significantly more words than did seven-year-olds ($p < .01$).

Within each age level, recall was higher in the Same-Categorizing conditions than in Categorizing conditions ($p<.01$) and recall increased over trials ($p<.01$). The advantage of Same-Categorizing over Categorizing instructions increased over trials for the seven-year-olds to a greater degree than for the ten-year-olds (see Figure 1).

Subjective Organization.

Bousfield's (1967) method of estimating sequential consistency in recall (ITR) was employed. The number of words recalled in adjacent positions on two consecutive trials was subtracted from those expected by chance. An analysis of variance was performed on means of the ITR scores grouped by threes over nine trials (Trials 4 through 12).

Results of the analysis of variance obtained for Overall effects (ages combined) indicate significant main effects for Age ($p<.01$), Instruction ($p<.01$), and Trials ($p<.01$). Significant interactions were Age x Trials ($p<.01$), Age x Instruction x Trials ($p<.05$), and Instruction x Sex x List ($p<.05$). The results demonstrate that, like overall recall, ITRs increased with age, and since the analysis of ITRs over trials revealed significant main effects for seven-year-olds to be Instruction ($p<.05$) and Trials ($p<.01$) and for ten-year-olds to also be Instruction ($p<.01$) and Trials ($p<.01$), it is clear that subjective organization increased over trials and was higher for the Same-Categorizing condition for both age groups.

The advantage of Same-Categorizing instructions in terms of ITR scores increased over trials for the ten-year-olds to a greater degree than for the seven-year-olds (Figure 2), an effect opposite to that found for recall scores measured over trials where seven-year-olds made greater comparative gains under Same-Categorizing instructions (Figure 1).

In the analysis of ITRs over trials, no interactions were significant for seven-year-olds, but for ten-year-olds significant interactions were Instruction x Trials ($p<.01$), and Instruction x Sex x List ($p<.05$).

Sorting Consistency.

Consistency of sorting trials is displayed graphically in Figure 3. Scores are based on mean number of words sorted into the same group on two adjacent sorting trials. Same-Categorizing instructions seem to have had a dramatic effect on maintenance of sorting consistency. Sorting consistency scores of Categorizing seven-year-olds increased only minimally over pairs of sorting trials (from 9.8 to 10.3) while scores of Same-Categorizing seven-year-olds increased from 13.83 to 27.17.

Ten-year-old Categorizing subjects demonstrated somewhat greater increases in sorting consistency (from 13.42 to 17.83) than did seven-year-old Categorizing subjects as might be anticipated from suggested developmental trends. Same-Categorizing ten-year-olds made pronounced increases in sorting consistency, from 18.67 to 33.00 across trials, and many individual subjects in this condition maintained perfect consistency in sorting over the last few trials.

Discussion

It has been suggested that achieving and maintaining stable organizational groupings may be a useful strategy in free recall learning tasks. The results of the present study indicate that instructions to maintain spatially consistent categories over sorting trials were effective in producing higher recall scores as well as more consistent categories over trials. Subjects receiving Same-Categorizing instructions also obtained significantly higher scores on a measure of intertrial repetitions (ITR) indicating that increased organization was operating at output. Since order of input was counterbalanced over trials and the same for both instructional conditions, this consistency could not be attributed to the ordering of input.

A relationship between recall scores, consistency in sorting, and number of intertrial repetitions was evident in this study. While Instruction appears to be an important factor in this relationship, it is also possible that a spatial cue, provided by the "anchoring device" (a gray sheet of cardboard with four white cards attached) was also interacting with the particular instructions used. This could have facilitated performance of Same-Categorizing subjects more than Categorizing subjects as it appears to be somewhat more appropriate to the instructions received by the former group. On the other hand, the presence of the gray card may have suggested the use of a consistent sorting strategy to children in the Categorizing groups and provided them with retrieval cues, thus improving their performance also.

In addition to serving as a framework for sorting, the gray card did appear to be providing retrieval cues for many children. During recall some subjects verbalized this as "and in this pile I had . . .", then named words placed in that particular pile before moving on to the next. Other children who reported using such deliberate techniques often mentioned strategies such as intentionally ordering piles for recall. Some stated they began recall with their "easiest" (or smallest) pile. Others reported starting with their more "difficult (or largest) pile. Several children vocalized systematically checking words during input to determine whether they had recalled them on previous trials and made a special effort during the next recall test to remember such words first. The notion that spatial cues may have an important positive effect on memory is not surprising. Research indicates that even young children may use various kinds of imagery as a highly effective aid to memory (Paivio, 1970; Rohwer, 1970)

Some investigators have suggested that younger children should benefit more from instructions to use effective organizational techniques than should older children since older children are presumed to more frequently engage spontaneously in effective organizational strategies. Some support for this position was evident in the results of this study. Categorizing seven-year-olds made minimal gains in mean recall scores over trials (from 9.8 to 10.3) while the seven-year-olds who received Same-Categorizing instructions made dramatic gains over trials (from 13.8 to 27.2). On the other hand, while Same-Categorizing ten-year-olds made pronounced gains (18.7 to 33.0) Categorizing ten-year-olds also made significant, though modest, gains over trials (from 13.4 to 17.8). Not in line with a developmental interpretation is gain in intertrial repetitions (ITR) over trials (Fig. 2). Here ten-year-olds showed reliably greater gains in subjective organization over trials as a function of Same-Categorizing instructions than did the seven-year-olds.

Summary

The present research was undertaken to study the effects of instructions on children's recall in a free recall learning task, and to observe the emergence of developmental trends presumed to be functioning. The results indicate that instructions to maintain spatially consistent categories over sorting trials were effective in producing more consistent categories and higher recall over trials for children of seven and ten years. A positive relationship between consistency in sorting, recall, and number of intertrial repetitions is suggested by the results and while instructions to maintain consistent categories seem to be an important factor, the possibility that the presence of a spatial cue also influenced obtained results cannot be overlooked.

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Appendix A: Words used in the experiment

List 1: diamond month evening heart dinner island water field family board valley husband flower finger dream garden rose office earth laugh love street girl news paint baby station stick head mind year idea bridge answer building air

List 2: grass sea wind bird dress bottle door chair milk sky table car food bed uncle mouth lady hair hour plant hand boat dollar coat time home people day book ring lake gold children room paper place

Appendix B: Instructions

I am interested in words that children already know and use. I'm going to show you a group of cards. There is one word on each card. When I show you a card, I'll tell you what the word on it is. Then I will hand you the card and I want you to say the word written on it aloud. Then put the card in one of four piles that I will tell you how to make. When you have finished going through all the cards in a deck, there will be four piles of cards. You will see several decks of cards before we are through. In each deck there are 36 cards with the same 36 words on them, and today we will be going through the cards 12 times.

Sorting Instructions:

I just want you to put the cards in four piles as you get them. Put the first card in the first pile, the second card in the second pile, the third card in the third pile, and the fourth card in the fourth pile. Then put the fifth card on top of the first card and the sixth card on top of the second card, and so on, like this. (Demonstrate with blank cards.) Are there any questions about what you are to do? (Answer any). Good. Let's start.

Categorizing Instructions after T_2

From now on I want you to think about the words on the cards and what they mean. Then I want you to put words that you think go together in the same piles. For example, when you think of 'snow', you might also think of 'ice' so those words would go in the same pile. So would 'ham' and 'eggs' go with each other, or 'cat' and 'dog' because you often think of them together. Here of course, you will have to put the words on the cards into only four piles, and not all the words will be ones that you would have chosen to use, but just do the best you can. (Demonstrate formation of piles, as in instructions for sorting). Remember, there is no right and no wrong way to make the piles, just as long as you choose words that you think go together and put them in the same pile.

Add for Categorizing Ss only:

We'll go through the cards just as we did before, I'll hand you the card and then you're to say the word just as you did before but this time you are to put the words together that seem to go together. You will see several decks of cards before we are through. Remember, you will be getting the same words on the cards each time. Do you understand?

Add for Same-Categorizing Ss only:

We'll go through the cards just as we did before. Remember, you will be getting the same words on the cards each time. Once you are satisfied with your piles I want you to try to remember which words go in each pile and put them in the same pile each time. If you put 'dog' in this pile (point) on one trial, try to put it in the same pile every time. Do you understand?

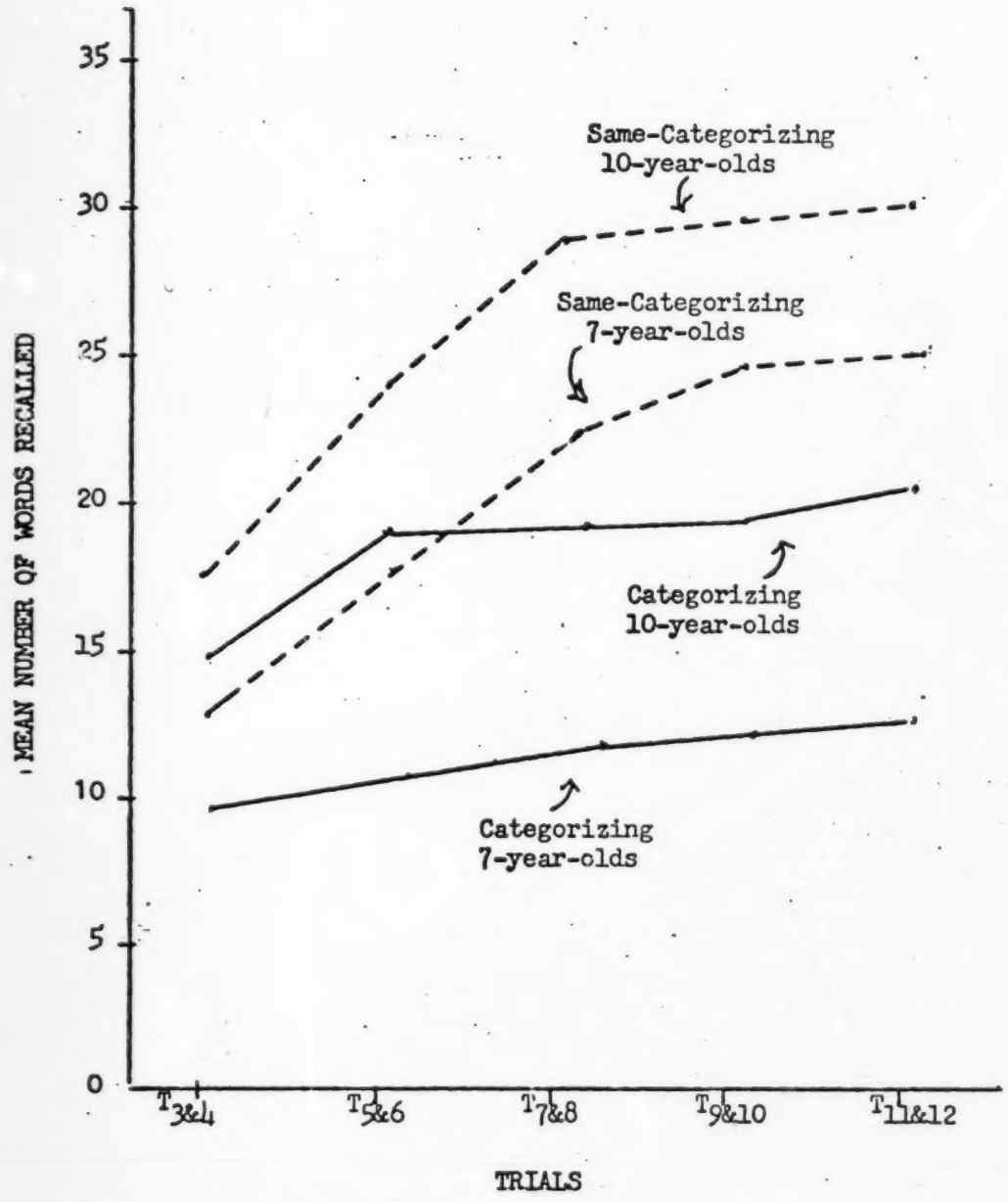

Fig. 1. Mean number of words recalled over trials expressed as means of two adjacent recall test scores.

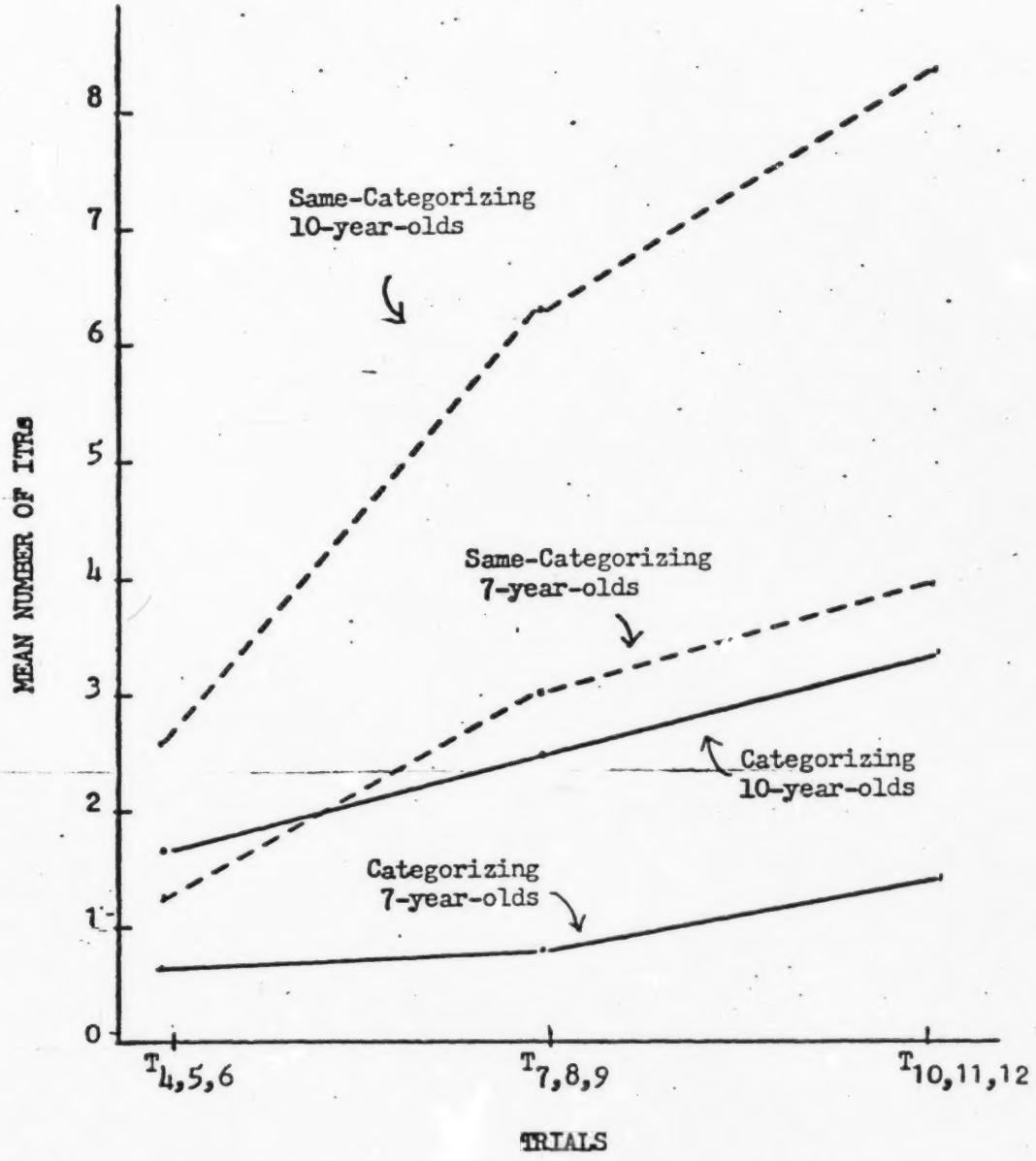

Fig. 2. Mean Number of ITRs blocked in groups of three over trials.

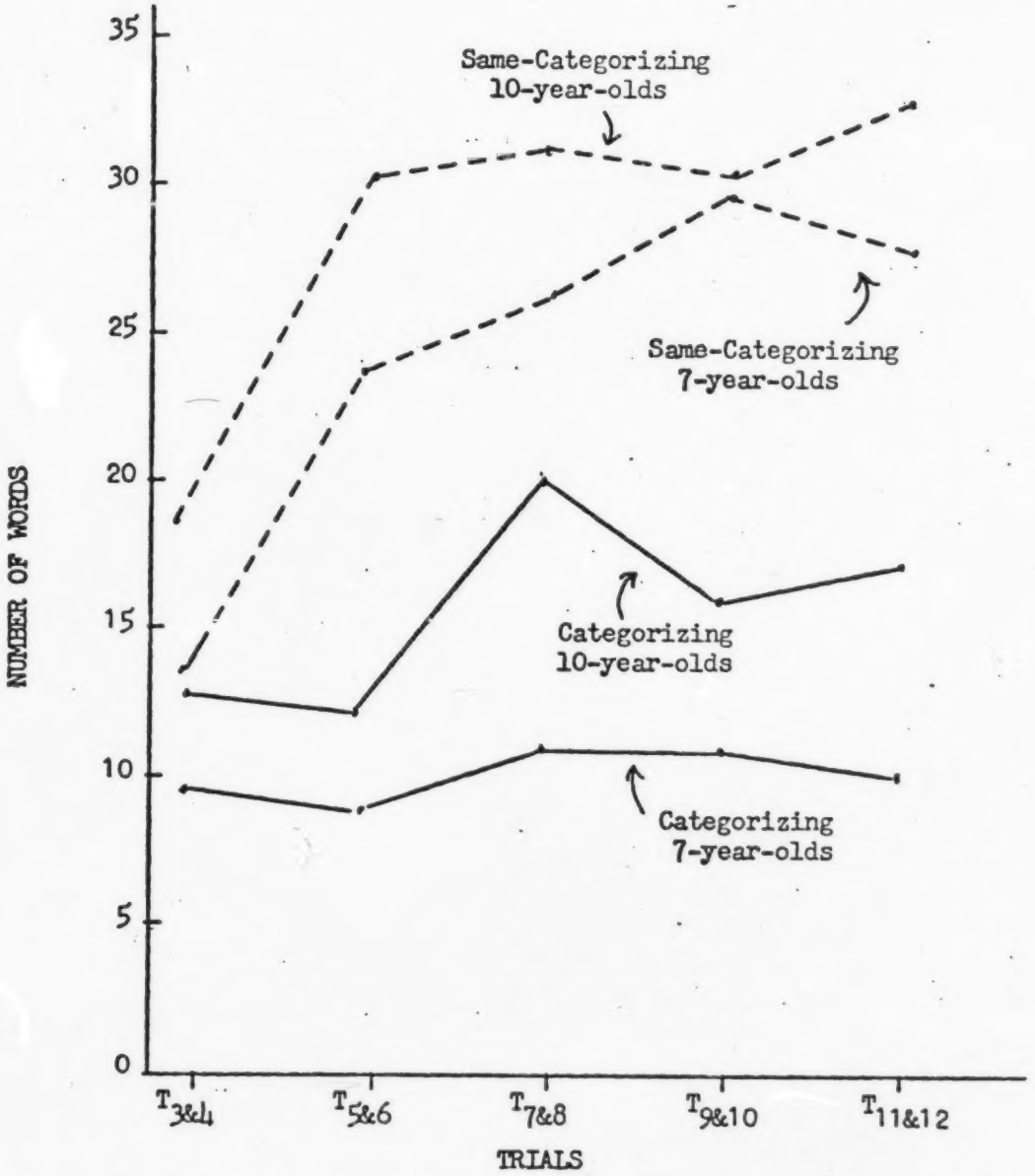

Fig. 3. Mean number of words sorted into same group on two adjacent sorting trials.

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